SPRING 2015 ENGINEERING DYNAMICS CORPORATION

Technical Newsletter

Available on-line in the EDC Library at www.edccorp.com

Austin was *Awesome!*

The 2015 *HVE* Forum is in the books. This was the first Forum held in Austin, Texas - and it won't be the last! Austin provided a great venue: The site at the Hilton Garden Inn has great workshop facilities. Located right on 6th Street downtown, there was a number of great eateries (how do you spell *B-A-R-B-E-Q-U-E!*), live music pouring out of every door, and, of course, over 30 workshops focusing on every aspect of *HVE*. And near-record attendance. The evaluations are in: One of the best Forums ever!

White Papers Available

Four *HVE* White Papers were presented at The Forum:

WP-2015-1 - "SIMON Simulation of Non-Automotive Vehicle Free Rolling Response," Thornhill Ramirez & Associates.

WP-2015-2 - "The Effect of Vehicle Geometry on HVE DyMESH Simulation Results," Principia Engineering.

WP-2015-3 - "HVE Vehicle Accelerometers: Validation and Sensitivity," Hrycay Consulting Engineers.

WP-2015-4 - "Evaluation of the Automatic Transmission Model in HVE v.10.10," Dial Engineering.

Our sincere appreciation goes out to the authors for their valuable contribution. These White Papers may be downloaded free of charge from the EDC website. Go to www.edccorp.com and select Library, then click HVE White Papers.

Save The Date!

The 2016 *HVE* Forum will be held in Phoenix, Arizona, during the week of February 22-26 at the Hilton Garden Inn Downtown. Make sure to mark your calendars!

The schedule of workshops, registration form with hotel information and other details will be published in September. Stay tuned!.

White Paper authors at the 2015 HVE Forum in Austin, Texas, from left to right: Clarence Long, Ciro Ramirez, Thornhill Ramirez & Associates; Kent McKee, Hrycay Consulting Engineers; Eric Rossetter, Yomi Agunbiade, Principia Engineering (with EDC President Terry Day standing in between); Eric Deyerl, Dial Engineering.

HVE Version 11.01

The newest *HVE* release is available for download from the EDC website. This is a patch release that contains bug fixes for Version 11, as well as some new functionality. To download this patch, go to the Support page and click on *Downloads*. You can also contact EDC Customer Service and request a CD.

SIMON Version 4.41

A patch is available for *SIMON*. This patch corrects a problem in the Collision Data report for collisions with multiple impulses. To download this patch, go to the Support page and click on *Downloads*. You can also contact EDC Customer Service and request a CD.

Inside This Issue

Technical Session

HVE Version 11 includes a new Traffic Signals Simulation System. It allows users to create working traffic signals and to include them in their *HVE* simulations. The system is applicable to all *HVE* and *HVE-2D*+ users (*HVE-2D* users with the 3-D Viewers option).

The Traffic Signals Simulation System includes three components:

Traffic Signal Editor – This is a new tool included in the 3-D Editor (see Figure 1). It allows the user to create and edit individual traffic signals. These signals are included in the current environment. An environment may have any number of individual traffic signals.

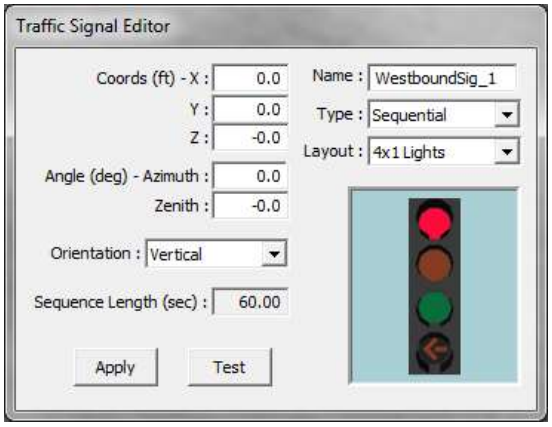


Figure 1 – Traffic Signal Editor Dialog, used for creating and editing the current traffic signal object

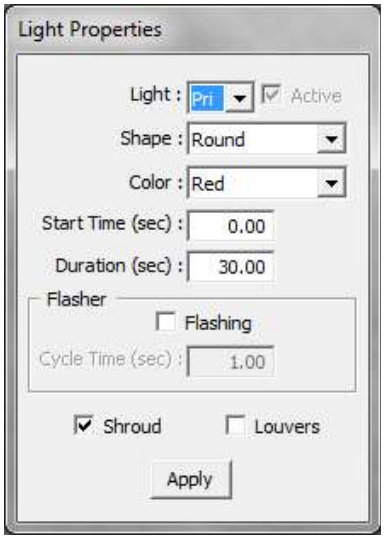


Figure 2 – Light Properties dialog, used for editing the properties of the individual lights in the current traffic signal.

The Traffic Signal Editor also includes a pop-up dialog, called the Light Properties dialog (see Figure 2), that replaces the Object Attributes dialog when the current object in the 3-D Editor is a traffic signal. The Light Properties dialog allows the user to edit the properties for each individual light in a traffic signal.

Traffic Signals Sequence Page – This is a new page in the Environment Information dialog. The Traffic Signals Sequence page (see Figure 3) allows the user to establish the relative timing for all of the individual traffic signals. For example, when one signal turns from yellow to red, another turns from red to green. Because each *HVE* case file has a single environment, the sequence information applies to every event.

Traffic Signals Set-up Dialog – This is a new option in the Event Set-up menu. The Traffic Signals Set-up dialog (see Figure 4) allows the user to choose the status of the signal sequence at the start of an event. For example, the user may wish to have the signals for

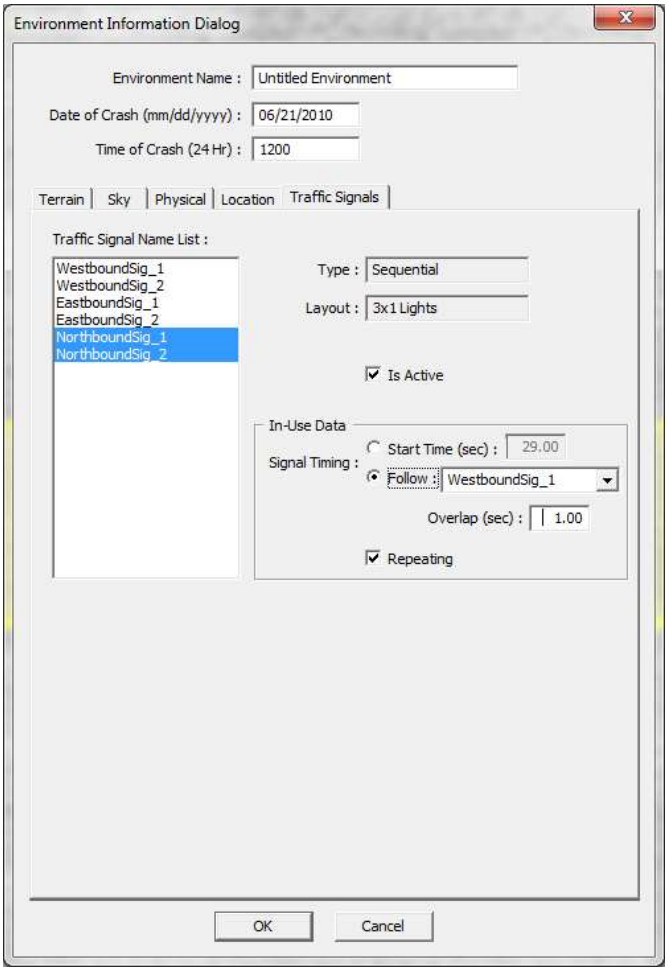


Figure 3 – Traffic Signals Sequence page, used for assigning the sequence of all the traffic signals.

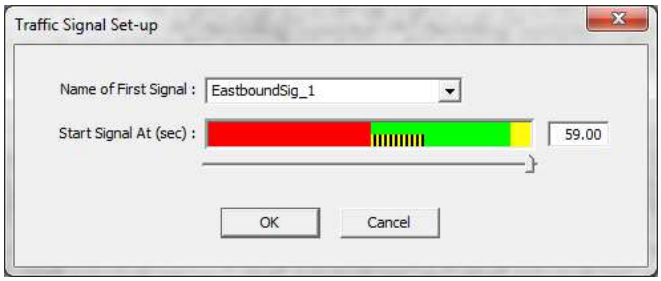


Figure 4 – Traffic Signals Set-up dialog, used for setting the state of the system of traffic signals at the start of an event.

westbound traffic turn from yellow to red at the start of the event.

The system is very robust, and allows users to create virtually any type and any number of traffic signal devices and include them as part of a complete traffic control system with inter-dependent signal timings. Although the current system applies only to vehicle traffic signals, the design is easily extendable to pedestrian and railroad traffic as well. These systems will be available in a future release.

Definitions

Here are some important definitions and related terminology:

Traffic Signal – A device with one or more individual lights.

Light – An individual light source that has specific light properties.

An individual traffic signal may include up to eight individual lights. Each light may be programmed with two independent *behaviors*. For example, a light may be a solid, red disk at the start of the sequence, then become a blinking red arrow later in the sequence; see below for more information.

Each traffic signal has the following attributes:

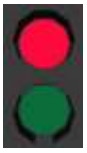
Type – Flashing or Sequential (default). A Flashing light alternates light sources (i.e., a signal with two red flashing lights that alternate). A Sequential light is the common traffic signal that has two or more (typically three, but may have up to eight) lights that operate sequentially. The most common example is a signal with three solid lights: first red, then green, then yellow.

Layout – This attribute determines the number of lights in the traffic signal, and how they are arranged within the traffic signal's rectangular frame. For Flashing signal types, the layout options are:

1 Light

2 Light

For Sequential signal types, the layout options are:



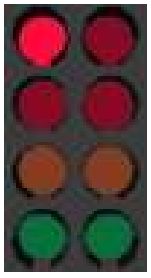
2 Light

3x1 Light

4x1 Light

5x1 Light

1+2x2 Light



4x2 Light

3x2 Light

2x2 Light

2x2+1 Light

2x1+1 Light

1+2x1 Light

Coordinates – The earth-fixed X,Y,Z coordinates of the center of the traffic signal device.

Angle – The earth-fixed Azimuth (horizontal) and Zenith (vertical) angles of the traffic Signal device.

Orientation – This attribute determines whether the signal is installed in Portrait (default) or Landscape mode.

Sequence Length – For Sequential signal types, this is the total time required for one complete sequence (cycle through all lights). This field is not user-editable; it is calculated internally by summing the durations for each individual light in the traffic signal.

Light Properties – The Behavior, Color, Shape, Start Time, Time Duration and Flasher properties for an individual light in the current traffic signal. Each of these properties is defined below.

Behavior – The Primary (default) or Secondary behavior option for color, shape, start time, time duration and flasher properties for the current light.

Color – An individual light may have the following colors: Red, Green, Yellow, White.

Shape – An individual light may have the following shapes: Solid, Directional Arrow (at specified angles), Cross, Bar.

Start Time – The time during an individual signal's sequence at which the current light turns on.

Duration – The length of time the current light is on.

Flashing – A checkbox that determines whether the current light flashes or is on continuously during the time duration which it is on.

Cycle Time – For flashing light types, the time length of the on-off cycle.

Typical Procedure

The following is a high-level overview of the procedure for adding one or more traffic signals to the current case:

- Add an environment.
- Launch the 3-D Editor.
- Select a traffic signal by clicking the Traffic Signal icon in the toolbar. A default 3-light signal appears at the earth-fixed origin.
- Choose the desired signal *Type, Layout, Orientation* and *Location* in the Traffic Signal Editor dialog.
- Click on an individual light in the Traffic Signal Editor dialog's mini-viewer. The properties for the selected light are displayed in the Light Properties dialog.
- Edit the properties (*Behavior, Shape, Color, Start Time, Duration* and *Flasher properties*) for the selected light.
- Repeat the previous two steps for each light in the current traffic signal. This creates the light sequence for the selected traffic signal.
- Repeat the previous five steps for as many traffic signals as you like (you can use *Edit, Copy/Paste* to create a copies of the current signal; this can save a lot of time!).
- Exit the 3-D Editor.

The signals are now displayed in the environment, but they're not yet sequenced relative to each other.

- Click on the Environment Information icon in the *HVE* toolbar (the hand icon pointing at the current Environment Name). The Environment Information dialog is displayed for the current environment.
- Click the Traffic Signals tab. The Traffic Signals Sequence page is displayed. This page displays a list of all the traffic signals created in the 3-D Editor.

The next step for the user is to activate or deactivate the desired signal(s) and assign the timing between the individual signals (i.e., when some of them turn red, others will turn green). By default, all signals are active.

- Choose the desired signal (or signals; multi-selection is useful for several signals that all change light color, i.e., red or green, at the same time).
- Confirm that the signal is active. This enables the time that the signal starts its sequence (see above).
- Enter the time at which the selected signal sequence starts. There are two ways to do this:

  1. Enter the start time for the signal(s) explicitly, or

  2. Click Follows and choose the name of a signal that the current signal's sequence is to follow.

- Repeat the previous three steps for each signal.
- Press *OK* to accept the signal sequence.

The sequence is now established for the entire signal system. The final step is to establish the starting point for the signal system in the event(s).

- Go to the Event Editor
- Choose *Set-up, Signals*. The Traffic Signal Set-up dialog is displayed.
- Choose the Signal Name of the signal that you want to use to start the sequence in your current event. A color bar will display the light color sequence for the selected signal, along with a time slider that is keyed to the signal's light sequence.
- Move the slider to the point in the light sequence where you want to start the event (i.e., if the selected signal is red for the first 20 seconds and you want the light to turn green 1 second into the event, move the slider to the time corresponding to 19 seconds).

- Set up the rest of the event (vehicle positions, velocities, driver controls, etc.).
- Execute. All the active signals will cycle through their user-defined sequences.

A complete tutorial for the Traffic Signals Simulation System is available. Contact EDC Customer Service if you would like to get a copy.

Rate This Tech Session

Please go to www.edccorp.com/TechSessionRating to tell us if you liked this Technical Session and to suggest other topics you'd like to see in future technical sessions. Thank you!

Dimension Basis Can Be Important!

Sprung Mass or *Total Mass*. That is the question.

History

HVE began life as a 3-D user environment. As such, it was designed to set up and execute physics models that employ 3-dimensional equations of motion, e.g., *SIMON, EDVSM, EDVDS*). These equations separately model the motion of the sprung mass (i.e., the vehicle's body) and the unsprung masses (i.e., the wheels and axles, which move independently from the body). These equations require that all dimensions be defined relative to the sprung mass's CG. Because of this, *HVE* stores all vehicle dimensions relative to the vehicle's sprung mass CG.

In the year 2000, EDC introduced *HVE-2D*. As it's name suggests, *HVE-2D* is a user environment designed to set up and execute physics models that employ 2-dimensional equations of motion, e.g., *EDSMAC, EDSMAC4, EDSVS, EDVTS* and *EDCRASH.* These equations lump the sprung and unsprung masses together; they do not model the motion of the wheels and axles separately from the body. These equations require that all dimensions be measured relative to the lumped (total) mass CG.

For passenger cars, pickups, vans and SUVs, the difference between the sprung mass CG location and the total mass CG location is not great (typically about an inch). But for large vehicles with solid axles, especially on-highway trucks, the difference can be much greater, as much as 30 inches or more. This requires the user of a 2-D physics model to reassign dimensions relative to the vehicle's total mass CG.

The location of the CG is important primarily because it determines a vehicle's weight distribution, which can affect handling behavior.

In December 2010, *HVE* Version 8.10 was introduced. Included was a new user preference option, called *Dimension Basis*, that allowed the user to switch conveniently between sprung mass dimensions and total mass dimensions. It works in a very simple way: If the *Dimension Basis* is set to *Total Mass*, before any vehicle-fixed dimension is displayed in a dialog, each internally stored (sprung mass) dimension is converted to total mass and then displayed in the dialog. Going the other way, any user-edited vehicle dimension is converted back to sprung mass basis before it is stored internally by *HVE*.

The current *Dimension Basis* is always displayed in *HVE*'s status bar at the bottom of the display.

Example

To illustrate, let's go to *HVE*'s Vehicle Editor and look at two vehicles: a 2001 Acura TL and a 2004 Freightliner Columbia with a sleeper cab. Note the current *Dimension Basis* in the status bar along the lower edge of the *HVE* window. If the *Dimension Basis* is *Total Mass*, change it to *Sprung Mass*:

- From the main menu, choose *Options, Preferences*.
- Change the *Dimension Basis* to *Sprung Mass*, and press *OK*.

Next, we need the vehicles.

- Go to the Vehicle Editor (if necessary).
- Add the 2001 Acura 3.2 TL passenger car.
- Add the 2004 Freightliner Columbia truck.

Now let's identify the difference between sprung mass and total mass dimensions. First, for the Acura:

- Click on the *Active Object List* and choose the Acura. The Acura is now displayed in the Vehicle Editor.
- Click on the right front wheel and choose *Wheel Coordinates*. The coordinates are displayed. Note the x-coordinate of the wheel is 39.06 inches.
- Click on the *Active Object List* and choose the Freightliner.
- Click on the right front wheel and choose *Wheel Coordinates*. The coordinates are displayed. Note the x-coordinate of the wheel is 82.42 inches.

Now let's look at those wheel coordinates using *Total Mass* dimension basis:

- From the main menu, choose *Options, Preferences*.
- Change the *Dimension Basis* to *Total Mass*, and press *OK*.

Now repeat the above process to look at the wheel coordinate in *Total Mass* dimension basis:

- Click on the *Active Object List* and choose the Acura.
- Click on the right front wheel and choose *Wheel Coordinates*. The coordinates are displayed. Note the x-coordinate of the wheel is 39.88 inches.

The difference in the x-coordinates (Total Mass - Sprung Mass) = 39.88 - 39.06 = 0.82 inches. So the total mass CG is 0.82 inches *behind* the sprung mass CG.

- Click on the *Active Object List* and choose the Freightliner.
- Click on the right front wheel and choose *Wheel Coordinates*. The coordinates are displayed. Note the x-coordinate of the wheel is 103.32 inches.

The difference in the x-coordinates (Total Mass - Sprung Mass) = 103.32 - 82.42 = 20.90 inches. So the total mass CG is 20.90 inches *behind* the sprung mass CG.

As you can see, the difference for the heavy truck is much greater than the difference for the passenger car. The reason, of course, is that the wheels and axles of the Freightliner are very heavy and make up a much greater percentage of the vehicle's total weight compared to the Acura.

Rule

As we have shown, there is a difference between sprung mass and total mass CG location, and it can be significant. This brings us to a simple rule:

> *3-D models should be executed using Sprung Mass dimension basis (actually, it doesn't really matter: 3-D models use sprung mass basis regardless of the current user preference), and 2-D models should be executed using Total Mass dimension basis (2-D models use dimensions according to the current user preference).*

Why did EDC decide to allow the 2-D physics user to choose Sprung Mass basis? We made that decision based on legacy: Prior to December 2010 when Version 8.1 was released, all 2-D physics users had set up their simulations using *Sprung Mass* basis (as it was the only option available).Dictating a change to *Total Mass* basis would have required all 2-D users to revise the set-up for every event.

EDC Simulations November 9 - 13, 2015 Miami, FL

EDC Simulations is an extensive one-week training seminar that offers an excellent way to learn the inner workings of *EDSMAC, EDSMAC4, EDSVS* and *EDVTS*. The course focuses on the physics models, the calculations and the underlying assumptions for each simulation's major calculation procedures.

EDC Simulations is designed like a college physics course - a combination of morning lectures and afternoon hands-on lab exercises. The fact that this course has been presented annually for over 25 years ensures that students benefit from a well designed and well executed week of instruction.

EDC Simulations has been pre-approved for 30 ACTAR CEUs. All course materials, including a handbook, training manual, software and temporary licenses will be provided to each student.

Bring your scientific calculator and laptop computer. Lab exercises include loss-of-control simulations, parametric studies, collision simulations and setting up the pre-impact phase of a 15-second crash sequence.

Links to download your course registration form and to make your hotel reservations at the University of Miami Holiday Inn, Coral Gables, are available on the EDC Simulations page in the Training section of edccorp.com. Contact EDC at 888.768.6216 to sign up today!

HVE and *HVE-2D* F.A.Q.

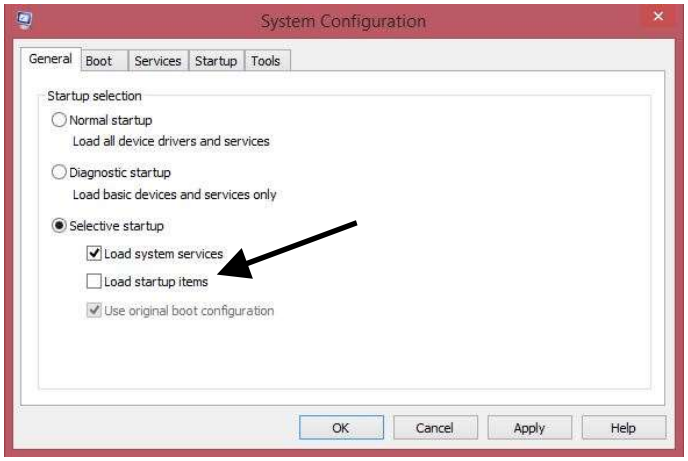
This section contains answers to frequently asked questions submitted to EDC Technical Support staff by *HVE* and *HVE-2D* users.

Q: *I am unable to install HVE Version 11. I have tried disabling my virus protection and starting in Safe Mode, but still no luck. Any more suggestions?*

A: First, a bit of background: The new Microsoft development tools used by *HVE* do not allow the *HVE* installation program to directly install run-time libraries in the *HVE* folder as was done in prior versions. Rather, the *HVE* installation program must use Microsoft's DLL installer, which copies required libraries directly to your computer's system folder. This was done in an effort to reduce the spread of computer viruses. Although the intension is good, the side effects are a real headache.

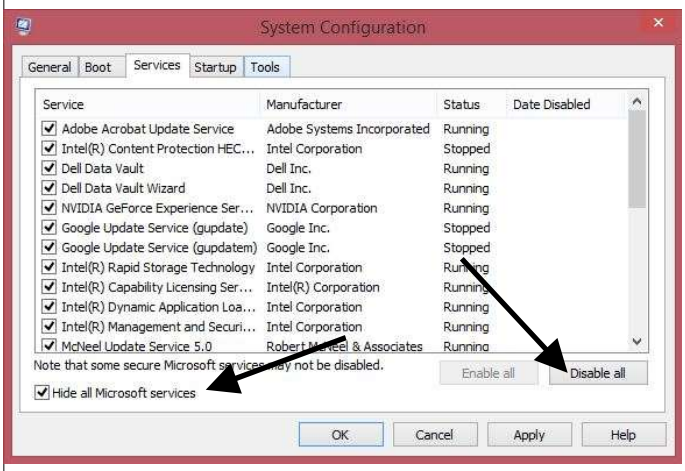
If you are having problems with *HVE*'s installer hanging once the progress bar is displayed then you should try the following procedure:

Step 1: Log onto your computer as *Administrator* and launch the Window's *Run* command. Type *MSCONFIG*, then click *OK*. This should bring up the System Configuration dialog, as shown below.



Step 2: Click on the *General* tab and choose *Selective Startup.* Uncheck the *Load Startup Items* check box (see arrow, above).

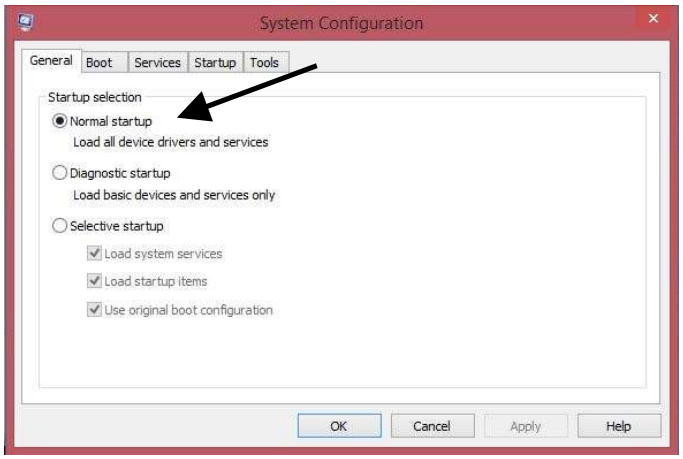
Step 3: Click on the *Services* tab to display the Services page (see below) and check the *Hide all Microsoft services* check box. Next, press the *Disable All* button, as shown below. Then click *OK*.



Step 4: Restart your computer.

Step 5: Install *HVE.*

Step 6: After *HVE* is successfully installed go back to the MSCONFIG utility (see **Step 1**) and choose *Normal Startup*, as shown below.



Q: I am running *HVE* Version 11 and I get the following Message: *No Node for This ID: 90460160*. This occurs after I have created a Trajectory Simulation report and a Video Creator window in the Playback Editor, and then return to the Event Editor. I am stuck.

A: This is a bug in Version 11 that is corrected by installing Version 11.01. The node number relates to a vehicle that has lights in the trajectory simulation report that are not properly managed when you return to the Event Editor. We apologize for the headache this is causing you!

Q: *What versions of Windows does HVE support?*

A: As of version 11.00, *HVE* supports Windows 7 and newer operating systems. (Sorry XP and Vista users! The latest suite of development tools dropped support for those operating systems.)

Q: *What DXF formats does HVE support?*

A: As of version 11.00, *HVE*'s DXF Translator supports Release 14 and newer DXF files.

Q: *Can I simulate a motorcycle using SIMON?*

A: Maybe; maybe not. Due to the load transfer that results from steering, coupled to the reduction in track width (motorcycles are typically modeled by setting the track width to 1 inch), *SIMON*'s roll degree of freedom will typically cause the motorcycle to fall over as soon as steering begins. To resolve the problem, use *EDSMAC* or *EDSMAC4*.

Visit the Support section of www.edccorp.com to download software updates and to view more FAQs from the Knowledge Base.

EDC Training Courses

EDC Reconstruction & Simulations

EDC offers excellent one-week courses on the use of the *EDCRASH* reconstruction program and the *EDSMAC*, *EDSMAC4*, *EDSVS* and *EDVTS* simulation programs. The **EDC Reconstruction** and **EDC Simulations** courses are designed to fully investigate the inner workings of these *HVE*-compatible physics programs. Lectures are full of helpful hints gained from years of experience. During the course, students will use the physics programs to complete several lab exercises highlighting the capabilities of each program discussed in the course.

All users of *HVE* and *HVE-2D* agree that these courses are extremely beneficial and challenging. It's the fastest way to learn what you really need to know – how to effectively use the physics programs and get the right results. *Note: These courses focus on the physics programs, not on the HVE user interface.* For courses that focus on the *HVE, HVE-2D* or *HVE-CSI* user interface, check out the workshops at the *HVE* Forum.

HVE Forum

The ***HVE* Forum** offers over 30 workshops designed to help *HVE, HVE-2D* and *HVE-CSI* users improve their modeling and application skills. By participating in workshops, attendees learn new techniques and also how to use the latest advancements in the software. The *HVE* Forum is also a great opportunity to meet other users and expand your network of resources.

Engineering Dynamics Corporation
Training Course Schedule

EDC Reconstruction

Miami, FL . . . . . November, 2016
Los Angeles, CA . . . . . January 18 - 22, 2016

EDC Simulations

Los Angeles, CA . . . . . January, 2017
Miami, FL . . . . . November 9 - 13, 2015

Theoretical & Applied Vehicle Dynamics

Upon Request

2016 *HVE* FORUM

Phoenix, AZ . . . . . February 22 - 26, 2016

Vehicle Dynamics

The **Theoretical & Applied Vehicle Dynamics** course extends the scope of a general vehicle dynamics discussion by including several direct applications using the *SIMON* vehicle dynamics simulation program within *HVE* and providing a solid theoretical background for such simulations. The course is focused towards engineers and safety researchers with an interest in an understanding of vehicle dynamics and automotive chassis systems development.

Course Registration

To register for a course, download a registration form from the Training page at edccorp.com or contact EDC Customer Service at 888-768-6216 or by email to training@edccorp.com. All courses are eligible for Continuing Education Units and ACTAR credits.

HVE Training Partners

HVE, *HVE-2D* and *HVE-CSI* users looking to improve their skills, but unable to attend one of EDC's regularly scheduled courses, can contact an *HVE* Training Partner for assistance. *HVE* Training Partners are experienced *HVE* and *HVE-2D* users who offer introductory and custom training courses on the use of *HVE*, *HVE-2D*, *HVE-CSI* and *HVE*-compatible physics programs. The list of *HVE* Training Partners may be found at www.edccorp.com.

HVE Discussion Groups

Websites hosted by experienced *HVE* Users offer information about using *HVE* as well as moderated online discussions with other users. Be sure to visit:

AccidentReconOnline.com - Online training courses and also the DiscoverHVE video tutorials and discussion group hosted by Wes Grimes of Collision Engineering Associates.

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